Advanced Life Support

training manual

This guideline was developed by:
The ALS Subcommittee,
National Committee on Resuscitation Training
Ministry of Health Malaysia
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Foreword

by
Director General of Health Malaysia
The 1st Basic Cardiac Life Support and Advanced Cardiac Life Support Course were held in Kuala Lumpur General Hospital in 1986. It was jointly organised by the Ministry of Health, Malaysian Society of Anaesthesiologists and National Heart Association in collaboration with the American Heart Association.

Since then, a number of changes have been made to both courses to cater to local needs. The Basic Cardiac Life Support Course was renamed Basic Life Support Course and shortened to one day. Similarly the Advanced Cardiac Life Support Course was renamed Advanced Life Support Course and reduced to two days.

However, material for the Advanced Cardiac Life Support Course was taken totally from the American Heart Association. With the formation of the Advanced Life Support Subcommittee under the umbrella of National Committee on Resuscitation Training, the Advanced Life Support Training Manual was compiled. I congratulate the Subcommittee for producing the training manual.

I hope the participants of the Advanced Cardiac Support Course will find the manual useful and comprehensive.

Thank you.
Chapter 1-10
chapter 1

Course Overview

The Advanced Life Support Course aims to train doctors and healthcare providers working in critical care areas in the resuscitation of patients beyond the ABC of resuscitation.

The course emphasizes on enhancing your skills in the treatment of arrest patients through active participation in a series of simulated cardiopulmonary cases. These simulations are designed to reinforce important concepts, including

- The Basic Life Support (BLS) Primary Survey
- The Advanced Life Support (ALS) Secondary Survey
- The ALS algorithms
- Effective resuscitation team dynamics

Course Objectives

Upon completion of this course, you should be able to

- Manage cardiac arrest until return of spontaneous circulation (ROSC), termination of resuscitation, or transfer of care
- Demonstrate effective communication as a member or leader of a resuscitation team and recognize the impact of team dynamics on overall team performance

Course Description

The course concentrates on skills both individually and as part of a team. Lectures are short and few. Therefore you are expected to have read the ALS provider training manual before the course. In addition, strong BLS skills are the foundation of ALS. You must have passed the 1-rescuer BLS/Automated External Defibrillator (AED) course before enrolment into the ALS course. The course programme is as follows:
**Day 1**

0730 - 0800h  Registration
0800 - 0810h  Course overview
0810 - 0840h  Lecture
  - Airway Management
0840 - 0910h  Lecture
  - Algorithm
0910 - 0940h  Lecture
  - Drugs
0945 - 1000h  Tea Break
1000 - 1215h  Skill stations:
  Airway, Defibrillation and ECG recognition + drugs with each station lasting 45 minutes
1215 - 1300h  ‘Put it all together’
1300 - 1400h  Lunch
1400 - 1700h  Megacode practice

**Day 2**

0815 - 0830h  Lecture
  - Ethics in resuscitation
0830 - 0930h  Theory test
0930 - 1300h  Megacode practice
1400 - 1700h  Test on Airway and Megacode
The BLS Primary Survey

The BLS goal is to support or restore effective oxygenation, ventilation, and circulation until ROSC or until ALS interventions can be initiated. Performance of the actions in the BLS Primary Survey substantially improves a patient’s chance of survival and a good (or better) neurologic outcome.

Before conducting the BLS Primary Survey, you should assess **Danger**, check patient **Responsiveness**, and **Shout for help** (activate emergency medical system and get an AED).

The BLS Primary Survey is an **ABCD** approach using a series of sequential assessments. Each assessment is followed by appropriate action(s) if needed. As you assess each step (the patient’s airway, breathing, circulation, and determine if defibrillation is needed), you stop and perform an action, if necessary, before proceeding to the next assessment step. Assessment is a key component in this approach. For example:

- Check for responsiveness before shouting for help and open the airway
- Check breathing before starting chest compressions
- Attach an AED, then analyze for a shockable rhythm before delivering a shock

**Remember:** assess...then perform appropriate action.

Table 1 below shows an overview of BLS Primary Survey. DRS is included before ABCD for completeness.

<table>
<thead>
<tr>
<th>Assess</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Danger</strong></td>
<td>Wear PPE (gloves, apron, mask) if available</td>
</tr>
<tr>
<td>- Are there blood spills, sharps, electric wires?</td>
<td>Make sure you, the victim and bystanders are safe</td>
</tr>
<tr>
<td>- Is the scene dangerous?</td>
<td></td>
</tr>
<tr>
<td><strong>Responsiveness</strong></td>
<td>Tap shoulders and Say ‘Hello! Hello! Are you OK?’</td>
</tr>
<tr>
<td>- Is the patient responsive?</td>
<td></td>
</tr>
<tr>
<td><strong>Shout for help</strong></td>
<td>‘Emergency! Emergency! Call ambulance 999 or bring emergency trolley &amp; defibrillator if available</td>
</tr>
</tbody>
</table>
### Assess

<table>
<thead>
<tr>
<th>Airway</th>
<th>Action</th>
</tr>
</thead>
</table>
| - Is the airway open? | Open the airway using non invasive techniques  
(head tilt-chin lift; jaw thrust without head extension if trauma is suspected) |

<table>
<thead>
<tr>
<th>Breathing</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Is the patient breathing and are respirations adequate?</td>
<td>Look for normal breathing in not more than 10s (almost simultaneously when performing head tilt chin lift)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circulation</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Is the patient breathing and are respirations adequate?</td>
<td>Perform high-quality CPR if not breathing or abnormal breathing (gasps) is seen until an AED arrives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Defibrillation</th>
<th>Action</th>
</tr>
</thead>
</table>
| - Is there a shockable rhythm?  
Check with a manual defibrillation or use an AED | Provide shocks as indicated Follow each shock immediately with CPR, beginning with chest compressions |

---

**NB.** Make every effort to minimize interruptions in chest compressions. Limit interruptions in chest compressions to no longer than 10s

### Avoid:

- Prolonged rhythm analysis
- Taking too long to give breaths to the patient
- Frequent or inappropriate pulse checks
- Unnecessarily moving the patient

---

**The ALS Secondary Survey**

The ALS Secondary Survey is conducted after the BLS Primary Survey when more advanced management techniques are needed.

Advanced airway interventions may include the laryngeal mask airway (LMA), or endotracheal tube (ETT).

Advanced circulatory interventions may include drugs to control heart rhythm and support blood pressure.

An important component of this survey is the differential diagnosis, where identification and treatment of the underlying causes may be critical to patient outcome.

In the ALS Secondary Survey, you continue to assess and perform an action as appropriate until transfer to the next level of care. Many times assessments and actions in ALS will be performed *simultaneously* by team members.
<table>
<thead>
<tr>
<th>Assess</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Airway</strong>&lt;br&gt;- Is the airway patent?&lt;br&gt;- Is an advanced airway indicated?</td>
<td>- Maintain airway patency in unconscious patients by use of head tilt-chin lift, oropharyngeal airway (OPA) or nasopharyngeal airway (NPA)&lt;br&gt;- Use advanced airways if needed (e.g. LMA or ETT)</td>
</tr>
<tr>
<td><strong>Breathing</strong>&lt;br&gt;- Are oxygenation and ventilation adequate?&lt;br&gt;- Is an advanced airway indicated?&lt;br&gt;- Is proper placement of airway device confirmed?&lt;br&gt;- Is tube secure and placement reconfirmed frequently?&lt;br&gt;- Are exhaled CO₂ and oxyhemoglobin saturation monitored?</td>
<td>- Give supplementary oxygen&lt;br&gt;- Assess the adequacy of oxygenation and ventilation by&lt;br&gt;  • Clinical criteria (colour, chest rise, auscultation)&lt;br&gt;  • Oxygen saturation&lt;br&gt;  • Capnometry or capnography&lt;br&gt;&lt;br&gt;The benefit of advanced airway placement is weighed against the adverse effects of interrupting chest compressions. If bag-mask ventilation is adequate, insertion of an advanced airway may be deferred until the patient fails to respond to initial CPR and defibrillation or until ROSC.&lt;br&gt;&lt;br&gt;If advanced airway devices are used:&lt;br&gt;- Confirm proper integration of CPR and ventilation&lt;br&gt;- Confirm proper placement of advanced airway devices by&lt;br&gt;  • Clinical criteria (colour, chest rise, auscultation)&lt;br&gt;  • Capnometry or capnography&lt;br&gt;- Secure the device to prevent dislodgment&lt;br&gt;- Continue exhaled CO₂ measurement</td>
</tr>
<tr>
<td><strong>Circulation</strong>&lt;br&gt;- What was the initial cardiac rhythm?&lt;br&gt;- What is the current cardiac rhythm?&lt;br&gt;- Have you established access for drug and fluid?&lt;br&gt;  Does the patient need volume (fluid) for resuscitation?&lt;br&gt;- Are medications needed for rhythm or blood pressure?</td>
<td>- Obtain IV / IO access&lt;br&gt;- Attach ECG leads and monitor for arrhythmias or cardiac arrest rhythms (e.g. VF, pulseless VT, asystole, and PEA)&lt;br&gt;- Give appropriate drugs to manage rhythm (e.g. amiodarone, lidocaine, atropine, magnesium) and blood pressure (e.g. adrenaline, vasopressin, and dopamine)&lt;br&gt;- Give IV / IO fluids if needed</td>
</tr>
<tr>
<td><strong>Differential Diagnosis</strong>&lt;br&gt;- Why did this patient develop cardiac arrest?&lt;br&gt;- Why is the patient still in arrest?&lt;br&gt;- Can we identify a reversible cause of this arrest?</td>
<td>• Search for, find and treat reversible causes (i.e. definitive care). Look for 5H and 5T causes.&lt;br&gt;  • 5H: Hypoxia, Hydrogen ion, Hypothermia, Hypovolemia, Hypo/hyperkalemia.&lt;br&gt;  • 5T: Tamponade (cardiac), Tension pneumothorax, Thrombosis (pulmonary or coronary), Toxins</td>
</tr>
</tbody>
</table>
Roles

Team Leader

Organizes the group, monitors individual performance of team members, backs up team members, models excellent team behavior, trains and coaches, facilitates understanding and focuses on comprehensive patient care.

Team Member

Must be proficient to perform skills within their scope of practice. They are clear about their role assignment, prepared to fulfill the role responsibilities, well practiced in resuscitation skills, knowledgeable about the algorithms and committed to success.

Team Dynamics and Communication

Closed Loop Communication

When communicating with team members, the leader should use closed loop communication. The leader gives an order or assignment and then confirms that the message was heard. The team member confirms that the order or assignment was heard and informs the leader when the task is complete.

Clear Messages

All messages and orders should be delivered in a calm and direct manner without yelling or shouting. The team leader should speak clearly while the team members should question an order if they are unsure what was said.

Clear Roles and Responsibilities

Every member of the team should know his/her role and responsibilities. To avoid inefficiencies, the team leader should clearly delegate tasks. A team member should not accept assignments above his/her level of expertise.

Knowing One’s Limitations

Every member of the team should know his/her limitations and capabilities and the team leader should be aware of them. A new skill should not be attempted during the arrest, instead call for expert help at an early stage.
Knowledge Sharing

A critical component of effective team performance is information sharing. The team leader can ask for suggestions when the resuscitation efforts seem to be ineffective.

Constructive Intervention

During a code, a team leader or member may need to intervene if an action is about to occur at an inappropriate time. The person recording the event may suggest that adrenaline be given as the next drug because it has been 5 minutes since the last dose. All suggestions for a different intervention or action should be done tactfully.

Reevaluation and Summarizing

An essential role of the team leader is monitoring and reevaluation of the status of the patient, interventions that have been done and assessment findings.

Mutual Respect

The best teams are composed of members who share a mutual respect for each other and work together in a collegial, supportive manner. All team members should leave their egos at the door.
Overview of Airway Management

The support of ventilation and oxygenation during CPR and the peri-arrest period are still important. The purpose of ventilation during CPR is to maintain adequate oxygenation and sufficient elimination of carbon dioxide. Airway obstruction by the tongue or any other foreign body must be excluded before the purpose of ventilation can be achieved.

It is also important to note that both systemic and pulmonary circulation are reduced markedly during cardiac arrest so that the normal ventilation perfusion relationships can be maintained with minute ventilation which is much lower than normal. Empirical use of 100% oxygen during resuscitation from cardiac arrest is reasonable.

Oxygen Delivering Devices

Oxygen administration is always appropriate for patient in acute distress. Various devices are used to deliver supplementary oxygen.

Table 3: Delivery of Supplementary Oxygen

<table>
<thead>
<tr>
<th>Device</th>
<th>Flow Rates</th>
<th>Delivered Oxygen (%) -approximate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasal cannula</td>
<td>1L/minute</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>2L/minute</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>3L/minute</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>4L/minute</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>5L/minute</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>6L/minute</td>
<td>44</td>
</tr>
<tr>
<td>Simple face mask</td>
<td>6-10L/minute</td>
<td>35-60</td>
</tr>
<tr>
<td>Venturi mask (Device specific)</td>
<td>4-12L/minute</td>
<td>24-60</td>
</tr>
<tr>
<td>Mask with O₂ Reservoir</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Rebreathing</td>
<td>10-15L/minute</td>
<td>70-80</td>
</tr>
<tr>
<td>• Non-rebreathing</td>
<td>10-15L/minute</td>
<td>95-100</td>
</tr>
</tbody>
</table>
**Nasal Cannula**

- Consists of 2 prongs
- Every 1L/minute increase in O\textsubscript{2} flow rate → increase in FiO\textsubscript{2} by 4%
- Usually 1-6L/minute O\textsubscript{2} given
- Do not use more than 6L/minute O\textsubscript{2} as this does not increase oxygenation much, yet dries up nasal passages and is uncomfortable to patient
- O\textsubscript{2} concentration depends on:  
  - O\textsubscript{2} supply flow rate
  - Pattern of ventilation
  - Patient inspiratory flow rate

**Simple Face Mask**

- Made from silicone rubber or transparent plastic
- Various size, from paediatric to big adult
- Adds 100 to 200 ml to the capacity of the O\textsubscript{2} reservoir
- Fits loosely on the face, which allows room air to be inhaled, if needed
- O\textsubscript{2} concentration depends on:  
  - O\textsubscript{2} supply flow rate  
  - Pattern of ventilation  
  - Patient inspiratory flow rate
- Supplies 35% to 60% oxygen with flow rates of 6 to 10L/minute
- Does not supply oxygen > 60%

**Venturi Mask**

- Based on Bernoullie principle
  - O\textsubscript{2} is passed through a narrowed orifice and this creates a high-velocity stream of gas. This high-velocity jet stream generates a shearing force known as viscous drag that pulls room air into the mask through the entrainment ports on the mask.
- Gives desired concentration of oxygen to patient (24% to 60%)
- Good for patient with chronic obstructive airway disease

**Mask with O\textsubscript{2} Reservoir**

- The addition of a reservoir bag to a standard face mask increases the capacity of the O\textsubscript{2} reservoir by 600 to 1000 ml. If the reservoir bag is kept inflated, the patient will inhale only the gas contained in the bag.
- There are two types of mask-reservoir bag devices:

<table>
<thead>
<tr>
<th></th>
<th>Rebreathing system</th>
<th>Non-rebreathing system</th>
</tr>
</thead>
<tbody>
<tr>
<td>No valve and so gas</td>
<td>No valve and so gas exhaled in the initial phase of expiration returns to the</td>
<td>Presence of a one-way valve that prevents any exhaled gas from</td>
</tr>
<tr>
<td>exhaled in the initial</td>
<td>reservoir bag</td>
<td>returning to the reservoir bag</td>
</tr>
<tr>
<td>phase of expiration</td>
<td>Provides up to 70% to 80% O\textsubscript{2} with flow rates of 10 - 15L/minute.</td>
<td>Provides up to 95% to 100% O\textsubscript{2} with flow rates of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 - 15L/minute.</td>
</tr>
</tbody>
</table>
Non-invasive Airway Devices

Oropharyngeal Airway

- A semicircular tube to hold the tongue away from the posterior wall of the pharynx
- Used in comatose patient or patient with loss of airway reflex
- May cause laryngospasm in semicomatose patient
- Various sizes (3,4,5)
  - The appropriate size is measured from angle of mouth to angle of jaw

Nasopharyngeal Airway

- An uncuffed tube made of soft rubber or plastic
- Used in patient where mouth opening is difficult
- More tolerable by semi-comatose patient
- Used with caution in patient with base of skull fracture or with ENT bleeding
- May cause airway bleeding in up to 30% patients
- Various sizes (size indicates internal diameter)
  - The appropriate size is measured from tip of the nose to tragus of the ear

Manual Assist Ventilation

In an unconscious or semiconscious victim, the healthcare provider should open the victim’s airway by head tilt-chin lift or jaw thrust (if suspected cervical injury). Oropharyngeal or nasopharyngeal airways may be used to prevent the tongue from occluding the airway.
**Mouth to Mask Ventilation**

- The mask is a pocket mask usually with one way valve
- Advantages:
  - Eliminates direct contact
  - Easier to perform than bag-mask ventilation
  - Oxygenates well if O₂ attached
  - Best for small-handed rescuers
- Two ways of carrying out mouth to mask ventilation depending on whether there are 1 or 2 rescuers

1- Rescuer Technique

- Performed from sides
- Rescuer slides over for chest compressions
- Fingers-head tilt-chin lift

2- Rescuer Technique

- The rescuer chest compression
- The ventilator stands at head end

**Bag-mask Ventilation**

[Diagram of bag-mask ventilation system]
• The bag-mask device consists of a self-inflating bag and a non-rebreathing valve
  - Can be used with a face mask or an advanced airway eg Laryngeal mask airway (LMA) or endotracheal tube (ETT)
  - Provides positive pressure ventilation
  - Cannot be used to allow spontaneous breathing
• The provider should use an adult (1 to 2 L) bag and deliver just enough volume to produce an obvious chest rise
• Bag-mask ventilation can produce gastric inflation with complications, including regurgitation and aspiration
• Two ways of holding the bag-mask device on the face for adequate ventilation:

  One Hand (E-C Clamp Technique)  
  Two Hand Technique

**Advanced Airways**

Bag-mask ventilation is not suitable for prolonged periods of ventilation as it also inflates the stomach. Therefore, ALS providers should be trained in the use of an advanced airway (supraglottic airways or ETT).

However, the provider should weigh the need for minimally interrupted chest compressions against the need for insertion of a supraglottic airway or an ETT.

**Supraglottic Airways**

Supraglottic airways are devices designed to maintain an open airway and facilitate ventilation. Insertion of a supraglottic airway does not require visualization of vocal cord and so it is possible to insert without interrupting chest compression during resuscitation.

A number of supraglottic airways are available:
Laryngeal mask airway (LMA), combitube and laryngeal tube. The LMA provides a more secure and reliable means of ventilation and is widely used in clinical practice.
**Laryngeal Mask Airway**

- An advanced airway device that is considered an acceptable alternative to the ETT
- Invented by Dr. Archie Brain, a British anaesthetist at London Hospital, Whitechapel in 1981
  - The invention causes a paradigm shift in airway management
- Used in over 100 countries worldwide
- Over 150 million users to date over 15 years
- When compared with the ETT, the LMA provides equivalent ventilation; successful ventilation during CPR has been reported in 72% to 97% of patients
- Technically easier to insert and should allow minimal interruption to chest compression during resuscitation
- Ventilating patient via LMA may still cause gastric aspiration
- Composed of a tube with a cuffed mask-like projection at the end of the tube and connected to a pilot balloon

**Versions of LMA**

Many different versions of LMA since its invention:

- LMA Classic - original reusable design
- LMA Unique - disposable version for use in emergency and prehospital setting
- LMA Fastrach (Intubating LMA) - as a conduit for intubation
- LMA Flexible - soft tubing and not for use in emergency setting
- LMA Proseal - additional channel for suctioning of gastric contents
- LMA Supreme - similar to Proseal but with built-in bite block
- LMA Ctrach - built-in fiber-optics with a video screen
**Recommended Size Guidelines for LMA**

The following table shows the Recommended Size Guidelines and the Amount of Air needed to inflate the LMA cuff:

<table>
<thead>
<tr>
<th>Size of LMA</th>
<th>Weight of patient</th>
<th>Max Air in Cuff Not to Exceed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size 1</td>
<td>&lt; 5 kg</td>
<td>4 ml</td>
</tr>
<tr>
<td>Size 1.5</td>
<td>5 to 10 kg</td>
<td>7 ml</td>
</tr>
<tr>
<td>Size 2</td>
<td>10 to 20 kg</td>
<td>10 ml</td>
</tr>
<tr>
<td>Size 2.5</td>
<td>20 to 30 kg</td>
<td>14 ml</td>
</tr>
<tr>
<td>Size 3</td>
<td>30 to 50 kg or small adult</td>
<td>20 ml</td>
</tr>
<tr>
<td>Size 4</td>
<td>50 to 70 kg (adult)</td>
<td>30 ml</td>
</tr>
<tr>
<td>Size 5</td>
<td>&gt; 70 kg (large adult)</td>
<td>40 ml</td>
</tr>
</tbody>
</table>

**Insertion of LMA**

Before any attempt to insert an LMA, the following equipment has to be prepared:

- Personal protective equipment - mask, eye shield/goggle, gloves
- Appropriate size LMA
- Syringe with appropriate volume (10, 20 or 50 ml) for LMA cuff inflation
- Water soluble lubricant
- Ventilation equipment
- Tape or other device(s) to secure LMA
- Stethoscope

The following are the steps necessary for successful insertion of LMA:

*Step 1:* Size selection - as per Recommended Size Guidelines
Step 2: Examination of LMA

- Inspect surface of LMA for damage, including cuts, tears, or scratches
  - Do not use the LMA if the airway tube is damaged in any way
- Inspect interior of LMA airway tube to ensure that it is free from blockage or loose particles
  - Any particles present in the airway tube should be removed as patient may inhale them after insertion
- Inflate cuff to ensure that it does not leak
- Deflate cuff to ensure that it maintains a vacuum

Step 3: Check inflation and deflation of cuff

- Inflatable cuff with the recommended volume of air
- Slowly deflate cuff to form a smooth flat wedge shape which will pass easily around the back of the tongue and behind the epiglottis

Step 4: Lubrication of LMA Cuff/Mask

- Use a water soluble lubricant to lubricate
- Only lubricate LMA cuff/mask just prior to insertion
- Only lubricate back of LMA cuff/mask thoroughly
- Avoid excessive lubricants on anterior surface or in the bowl of cuff/mask as inhalation of the lubricant following placement may result in coughing or obstruction

Step 5: Position head for insertion

- LMA can be inserted even if the head is in the neutral position as long as the mouth opening is adequate
- Avoid LMA fold over:
  - Assistant pulls the lower jaw downwards
  - Visualize the posterior oral cavity
  - Ensure that LMA is not folding over in the cavity as it is inserted
Below are a series of diagrams showing the insertion of LMA:

1. Method for holding the LMA for **standard** insertion technique

2. With the head tilt and the neck flexed, insert the cuff of LMA into the oral cavity; direction of force goes against the hard palate

3. To facilitate introduction of LMA into the oral cavity, gently press the middle finger down onto the jaw

4. The index finger pushes LMA in a cranial direction following the contours of the hard and soft palates
5 Maintaining pressure with finger on LMA in the cranial direction, advance LMA until definite resistance is felt at the base of the hypopharynx: note flexion of the wrist

6 Gently maintain cranial pressure with non-dominant hand while removing index finger

8 To allow LMA to seat optimally, inflate without holding LMA

   Inflate cuff with just enough air to obtain a seal - this should correspond to intracuff pressures around 60 cm H₂O; do not over-inflate

9 Tape the bite-block and LMA airway tube downwards against the chin
Final words on LMA

- Test cuff before use
- Don’t lubricate anterior side of LMA mask
- Insert only in comatose patient
- Keep cuff inflated until patient awake

Endotracheal Tube (ETT)

The ETT is usually regarded as the “Gold Standard” of airway control while endotracheal intubation is a highly skillful procedure that requires adequate training and ongoing maintenance of skill.

The ETT was once considered the optimal method of managing airway during cardiac arrest. It keeps the airway patent, permits suctioning of airway secretions, enables delivery of a high concentration of oxygen, provides an alternative route for the administration of some drugs, facilitates delivery of a selected tidal volume, and with the use of a cuff, may protect the airway from aspiration.

However, it is now clear that the incidence of complications is unacceptably high when intubation is performed by inexperienced providers. Interruption of chest compression significantly reduces chance of ROSC. ALS provider therefore must weigh the risks and benefits of endotracheal intubation during resuscitation against prolonged interruption of chest compression. If endotracheal intubation is deemed essential, it should be done by the most experienced personnel and chest compression should not be interrupted for more than 10-20s. Alternatively, if ventilation is adequate with bag-mask or supraglottic devices, endotracheal intubation for cardiac arrest may be delayed until ROSC.

Equipment for Endotracheal Intubation:

The equipment necessary for endotracheal intubation may be remembered as mnemonics MALES:

M - Mask (Bag-mask), Magill forceps  
A - Airways (Oropharyngeal/Nasopharyngeal Airway)  
L - Laryngoscope, LMA, Lubricant gel  
E - Endotracheal tubes + Stylet + tape for securing ETT  
S - Suction (Catheter/Yaunker), Syringe, Stylet

Laryngoscope

- Consists of handle (which contains a battery power source) and blade  
- 2 types of blades: Macintosh blade (curved) for adults Miller blade (straight) for newborn and infants  
- Make sure that the light on the blade works and is bright when lit up
**Endotracheal Tube**

“Typical” modern ETT has the following features:

- Marked with
  - Size with internal diameter in mm; external diameter in smaller lettering
  - Z-79 which denotes that the material has been implantation tested in rabbit muscle for tissue compatibility
  - Distance from the tip of ETT at intervals along ETT’s length. Most plastic tubes are longer than is usually required and may be cut to size
  - Other markings which may refer to the manufacturer, the trade name of the type of ETT, and whether it is intended for oral or nasal use
  - A radio-opaque line to aid detection of ETT on chest X-rays
- Curved with a left-facing bevel at the distal. A hole in the wall opposite the bevel (Murphy eye) allows ventilation should the end become obstructed by the tracheal wall or mucus or secretions
- Attached to a ETT connector at the proximal end
- May bear a cuff near the distal end, with a pilot balloon running towards the proximal end. The cuff is of high volume and low pressure type to reduce pressure on the tracheal mucosa

<table>
<thead>
<tr>
<th>Age</th>
<th>Internal Diameter (mm)</th>
<th>Anchor for Oral ETT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Male</td>
<td>8 - 8.5</td>
<td>20 - 22 cm</td>
</tr>
<tr>
<td>Adult Female</td>
<td>7 - 7.5</td>
<td>18 - 20 cm</td>
</tr>
<tr>
<td>Newborn to 3 months</td>
<td>3</td>
<td>weight (kg) +6</td>
</tr>
<tr>
<td>Infants</td>
<td>3 - 3.5</td>
<td>weight (kg) +6</td>
</tr>
<tr>
<td>Children &gt;1year</td>
<td>(Age/4) + 4</td>
<td>3 times size of ETT used/ (Age/4)+12</td>
</tr>
<tr>
<td>If using cuffed ETT</td>
<td>(Age/4) + 3.5</td>
<td></td>
</tr>
</tbody>
</table>

**Choosing The Correct Size ETT**

**Preparation for Endotracheal Intubation**

It is important to get ready before any attempt in intubation:

- Ensure equipment ready and in good order: **MALES**
- Ensure adequate oxygen source
  - wall or cylinder
  - if oxygen source is from oxygen cylinder, check O₂ pressure
- Ensure enough helping hands
- Ensure equipment to monitoring success of placement of ETT ie Stethoscope, End-tidal CO₂ monitor and Pulse oximeter ready and in good order
- Ensure resuscitation and intubation drugs available and ready
The Technique of Endotracheal Intubation

The following are steps necessary for successful endotracheal intubation during cardiac arrest:

**Step 1:** Position patient in the ‘sniffing the morning air’ position

- Flexion at lower cervical spine
- Extension at atlanto-occipital joint

To align the axes of upper airway as shown in the diagram below

![Diagram showing the alignment of upper airway axes](image)

- Extend-the-head-on-neck (“look up”): aligns axis A relative to B
- Flex-the-neck-on-shoulders (“look down”): aligns axis B relative to C

**Step 2:** Preoxygenation

- 100% $O_2$ for 3 minutes or with 4 vital capacity breaths

**Step 3:** Laryngoscopy and insertion of ETT
3A: Laryngoscopy

- Use left hand to hold laryngoscope
- Enter at right side of mouth and push tongue towards left side
- Move the laryngoscope blade toward midline and advance to the base of tongue. Advance the blade to the vallecula if the curved blade is used or to just beyond tip of epiglottis if the straight blade is used
- Lift upward and forward to bring the larynx and vocal cords into view as indicated by the arrow in the diagram above. The direction of force necessary to lift the mandible and tongue is 45 degrees. Do not use the teeth as a fulcrum or a lever

3B: Insertion of ETT

- Insert the ETT through the vocal cords. View the proximal end of the cuff at the level of the vocal cords and advance it about 1 to 2.5cm further into the trachea
- Inflate the ETT with enough air to occlude the airway (usually 10 to 20ml)

Important point to note:
Time taken for laryngoscopy and insertion of ETT should not be more than 30 seconds and preferably less than 15 seconds.

Step 4: Confirm correct position of ETT

- Observe colour of patient
- Visualise chest rise with delivery of first manual breath
- Detect vapour in ETT
- 5 points auscultation for breath sounds (auscultate epigastrium, anterior chest at bilateral mid-clavicular lines and thorax at bilateral mid-axillary lines)
- Detect end-tidal CO₂ with capnography or CO₂ detector device
**Step 5:** Secure ETT with tape

**Step 6:** Ventilate with a tidal volume of 6-8 ml/kg (visible chest rise) at a rate of 8-10 breath per minute

**Use of Devices to Confirm Correct ETT Placement Via Detection of CO₂ Production**

Detection of end-tidal CO₂ during resuscitation:

- Confirms ETT placement; note that EtCO₂ detection will not differentiate between tracheal and endobronchial tube placement. Careful auscultation is essential
- Correlates with cardiac index
- Assesses adequacy of ventilation
- Indicates quality of CPR
- Signifies ROSC
- Carries prognostic value for survival post cardiac arrest

There are a number of CO₂ detector devices available:

i) Esophageal detector device  
ii) End-tidal CO₂ (EtCO₂) detector device  
iii) Disposable calorimetric EtCO₂ detector  
iv) Continuous digital EtCO₂ detector device  
v) Continuous waveform EtCO₂ capnography

**Complications of Endotracheal Intubation**

<table>
<thead>
<tr>
<th>During intubation</th>
<th>Hypoxia from the procedure itself, esophageal intubation and/or laryngospasm and bronchospasm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hypertension/hypotension, tachycardia/bradycardia and arrhythmias from/parasympathetic/sympathetic response</td>
</tr>
</tbody>
</table>
### During intubation

- Hypoxia from the procedure itself, esophageal intubation and/or laryngospasm and bronchospasm
- Hypertension/hypotension, tachycardia/bradycardia and arrhythmias from parasympathetic/sympathetic response
- Trauma to teeth, lips, tongue, mucosa, vocal cords, trachea
- Vomiting and aspiration
- Arytenoid dislocation → hoarseness
- Spinal cord trauma in cervical spine injury

### When ETT in-situ

- Migration to bronchus/esophagus
- Obstruction from kinking, secretions or over-inflation of cuff
- Disconnection from breathing circuit
- Accidental extubation/ETT dislodgement
- Lip ulcer in prolonged oral intubation
- Sinusitis or otitis or nasal ulcer in prolonged nasal intubation
- During extubation: Laryngospasm
- Edema of upper airway
- Pulmonary aspiration

### After Extubation

- Sore throat
- Hoarseness

### Long Term

- Subglottic stenosis
- Vocal cord granuloma
- Laryngeal granuloma

---

**Ventilation with an Advanced Airway and Chest Compression**

When a cardiac arrest patient has an advanced airway in place during CPR, there is no more cyclical CPR (i.e. 30 compression interrupted by pauses for 2 ventilations).

- Chest compressions are delivered at rate of at least 100 per minute
- Ventilations are delivered at 8 to 10 per minute (1 ventilation every 6-8 seconds)
- Ventilator and compressor should switch role every 2 minutes to prevent compressor fatigue and deterioration in the quality of CPR
- Minimize interruptions in chest compressions
- Avoid excessive ventilations (too many breaths or too large a volume). A lower rate and just adequate tidal volume ventilation is recommended to avoid hyperventilation and over-inflation of the lungs.
Tracheobronchial Suctioning

Suction Catheter

- Size (FG) = ETT internal diameter (mm) x 3/2 or outer diameter should not exceed 1/2 to 2/3 ETT internal diameter
- Minimal trauma to mucosa with molded ends and side holes
- Long enough to pass through tip of ETT
- Minimal friction resistance during insertion through ETT
- Sterile and disposable

Suction Pressure

- 100 to-120mmHg (adults)
- 80 to-100mmHg (children)
- 60 to-80 mmHg (infants)

Complications of Tracheobronchial Suctioning:

- Sudden severe hypoxia, secondary to decrease in functional residual capacity during the application of negative pressure in the trachea
- Cardiac arrest if severe hypoxia
- Increase in intra-arterial pressure and tachycardia due to sympathetic response to suction

Technique of Tracheobronchial Suctioning:

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Always preoxygenate with 100% O\textsubscript{2} for 3-5 minutes to reduce risk of hypoxia and arrhythmias</td>
</tr>
<tr>
<td>Step 2</td>
<td>Using sterile technique, the suction catheter is inserted without closing the side opening in the proximal end of the catheter</td>
</tr>
<tr>
<td>Step 3</td>
<td>The suction catheter is advanced to the desired location which is approximately at the level of the carina where trachea bifurcates</td>
</tr>
<tr>
<td>Step 4</td>
<td>Suction is applied intermittently by closing the side opening while the catheter is withdrawn with a rotating motion</td>
</tr>
<tr>
<td>Step 5</td>
<td>Limit duration of suctioning to 10-15 seconds. If arrhythmias occur, immediately discontinue suctioning and manually bag patient with O\textsubscript{2}</td>
</tr>
<tr>
<td>Step 6</td>
<td>Prior to repeating the procedure, patient should be ventilated with 100% O\textsubscript{2} for about 30 seconds.</td>
</tr>
</tbody>
</table>

Point to note:

In patient with elevated intracranial pressure (e.g. head injury), temporary hyperventilation before and after suctioning may be indicated
What is Defibrillation?

- The passage of an electrical current across the myocardium to depolarise a critical mass of myocardium and enable restoration of coordinated electrical activity
- An electrophysiological event that occurs 30-50 ms after shock delivery—the heart is stunned and hopefully the sino-atrial (SA) node will take over
- Aims to restore sinus rhythm
- Typically defined as the termination of ventricular fibrillation (VF) for at least 5 after the shock. Shock success using this definition does not equal to resuscitation outcome
- Only for VF or pulseless ventricular tachycardia (VT) where a single shock is given followed immediately by chest compression without any pulse check or rhythm reanalysis after a shock

The Importance of Early Defibrillation

Early defibrillation is critical to survival from sudden cardiac arrest (SCA) for the following reasons:

1) Most frequent initial rhythm in out-of-hospital witnessed SCA is VF
2) Treatment for VF is defibrillation
3) The probability of successful defibrillation diminishes rapidly over Time
4) VF tends to deteriorate to asystole over time

For every minute that passes between collapse and defibrillation, survival rates from witnessed VF SCA decrease 7% to 10% if no CPR is provided. When bystander CPR is provided, the decrease in survival rates is more gradual and averages 3% to 4% per minute from collapse to defibrillation.

CPR prolongs VF, delays the onset of asystole and extends the window of time during which defibrillation can occur. Basic CPR alone, however, is unlikely to terminate VF and restore a perfusing rhythm.

Defibrillators

Modern defibrillators are classified according to 2 types of waveforms: monophasic and biphasic. Monophasic waveform defibrillators were introduced first, but biphasic waveforms are used in almost all Automated External Defibrillators (AEDs) and some manual defibrillators sold today. Energy levels vary by type of device and manufacturer.
Monophasic Waveform Defibrillators

• Deliver current of one polarity (i.e. direction of current flow)
• Categorized by the rate at which the current pulse decreases to zero:
  - Monophasic damped sinusoidal waveform (MDS) current returns to zero gradually
  - Monophasic truncated exponential waveform (MTE) current returns abruptly (truncated) to zero

Biphasic Waveform Defibrillators

• Equivalent or higher efficacy for termination of VF when compared with monophasic waveforms
• Different biphasic waveforms have not been compared with regard to efficacy
• Use the manufacturer’s recommended energy dose (120 to 200J). If the manufacturer’s recommended dose is not known, defibrillate at 200J, the maximal dose

Preparing The Patient

Electrode/Paddle Size

• Minimum 150 cm², 8 to 12 cm in diameter for both handheld paddle electrodes and self-adhesive pad electrodes although defibrillation success may be higher with electrodes 12 cm in diameter rather than with those 8 cm in diameter
• Small electrodes (4.3cm) harmful and may cause myocardial necrosis

Electric/Paddle force

• 8kg in adult
• 5kg in 1-8 years when using adult paddles

Transthoracic Impedance

• Use gel pads or electrode paddles or self-adhesive pads to reduce transthoracic impedance. The average adult human impedance is 70 to 80 Ω. When transthoracic impedance is too high, a low-energy shock will not generate sufficient current to achieve defibrillation

Electrode/Paddle Placement

• Can be at antero-lateral, antero-posterior, anterior-left infrascapular and anterior-right infrascapular locations on the chest/back. All these 4 positions are equally effective. For ease of placement and education, anterolateral is a reasonable default electrode placement.
• Ensure that the paddle and gel or pads are in full contact with the skin
• Special considerations:
Breasts
- Place lateral pads/paddles under breast tissue
- Move pendulous breasts gently out of the way

Wet Chest
- Briskly wipe the chest dry before attaching electrode pads and attempting defibrillation

Hirsutism
- Shave hirsute males prior to application of pads
- Remove excess chest hair by briskly removing an electrode pad (which will remove some hair) or by rapidly shaving the chest in that area

Automated Implanted Cardioverter Defibrillator
- Avoid placing the pads or paddles over the device as there is a potential for pacemaker or ICD to malfunction after defibrillation when the pads are in close proximity to the device
- Use antero-posterior and antero-lateral locations

Presence of Transdermal Medication Patch (e.g., patch containing nitroglycerin, nicotine, analgesics, hormone replacement, anti-hypertensives)
- Do not place electrodes over transdermal medication patch which may block delivery of energy from the electrode pad to the heart and may cause small burns to the skin
- Remove medication patch and wipe the area before attaching the electrode pad if defibrillation is needed

Safety Issues

Fire
- Ignited by sparks from poorly applied defibrillator paddles in the presence of an oxygen-enriched atmosphere
- Avoid defibrillation in an oxygen-enriched atmosphere
- Use self-adhesive defibrillation pads
- Ensure good pad–chest-wall contact
- If manual paddles are used, gel pads are preferable to electrode pastes and gels because the pastes and gels can spread between the 2 paddles, creating the potential for a spark

Accidental Electrocution
- Charge paddles after being placed on patient’s chest rather than prior to being taken out from the defibrillator
- Ensure that none of the rescuer team members is in contact with patient/victim/resuscitation trolley prior to defibrillator discharge

Safety and Clearing The Patient
- Always announce that a shock is about to be delivered
- Perform a visual check making sure no one is in contact with the patient
- “Clear” the patient and rescuers before each shock
• Make sure that no oxygen is flowing across the patient’s chest or openly across the electrode pads
• Carry out the above steps quickly to minimize the time from the last compression to shock delivery

An Example:

“**One I Clear**”
(Check to make sure you have no contact with the patient, the trolley or other equipment)

“**Two, You Clear.**”
(Check to make sure that no one is touching the patient. “No one” includes providers performing chest compressions, starting IVs, inserting catheters, or performing ventilation and airway maintenance)

“**Three, Everybody Clear.**”
(Perform a visual check to make sure no one has contact with the patient or trolley)

These steps are summarized below:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Attach electrodes to patient’s chest</td>
</tr>
<tr>
<td>2</td>
<td>Turn defibrillator on – select leads</td>
</tr>
<tr>
<td>3</td>
<td>Analyse the rhythm? shockable</td>
</tr>
<tr>
<td>4</td>
<td>Apply coupling agent or pads to patient’s chest</td>
</tr>
<tr>
<td>5</td>
<td>Select energy level</td>
</tr>
<tr>
<td>6</td>
<td>Apply paddles to chest</td>
</tr>
<tr>
<td>7</td>
<td>Charge the paddles</td>
</tr>
<tr>
<td>8</td>
<td>The “<strong>Clear</strong>” chant</td>
</tr>
<tr>
<td>9</td>
<td>Check monitor again</td>
</tr>
<tr>
<td>10</td>
<td>Discharge shock and return the paddles to the machine</td>
</tr>
</tbody>
</table>
Synchronized Cardioversion

- A shock delivery that is timed (synchronized) with the QRS complex
- Avoids shock delivery during the relative refractory portion of the cardiac cycle when a shock could produce VF

Use of Synchronized Cardioversion

- Indicated in a hemodynamically unstable patient (low blood pressure) with a perfusing rhythm (pulse present)
- Recommended in supraventricular tachycardia due to re-entry, atrial fibrillation, atrial flutter, and atrial tachycardia
- Recommended in monomorphic VT with pulses
- Not effective for treatment of junctional tachycardia or multifocal atrial tachycardia

Initial Recommended Energy Level for Synchronized Cardioversion

- Narrow Regular: 50-100J
- Narrow Irregular: 120-200 biphasic or 200J monophasic
- Wide Regular: 100J
- Wide Irregular: defibrillation (NOT synchronized, 360J monophasic or 120-200J biphasic)

Supraventricular Tachycardias (Re-entry Rhythms)

- Cardioversion of Adult Atrial Fibrillation:
  Initial energy dose- biphasic 120 to 200J or monophasic 200J
  If the initial shock fails, increase the dose in a stepwise fashion
- Cardioversion of Adult Atrial Flutter and Other Supraventricular Tachycardias:
  Initial energy dose- 50 to 100J often sufficient
  If the initial shock fails, increase the dose in a stepwise fashion

Ventricular Tachycardia (VT)

- Pulseless VT
  - Treat as VF

- Unstable Polymorphic (Irregular) VT With or Without a Pulse
  - Treat as VF using defibrillation doses

- Unstable Monomorphic (Regular) VT With a Pulse
  - Treat with monophasic or biphasic waveform cardioversion (synchronized) at an initial energy dose of 100J. If the initial shock fails, increase the dose in a stepwise fashion.
Points to know:
Synchronized cardioversion is preferred for treatment of an organized ventricular rhythm. However, for some arrhythmias, the many QRS configurations and irregular rates that comprise polymorphic ventricular tachycardia make it difficult or impossible to reliably synchronize to a QRS complex. If there is any doubt whether monomorphic or polymorphic VT is present in the unstable patient, do not delay shock delivery to perform detailed rhythm analysis—provide high energy unsynchronized shocks (i.e., defibrillation doses, 360J monophasic or 120-200J biphasic).

Pacing

- Not recommended for patients in asystolic cardiac arrest as it is not effective and may delay or interrupt the delivery of chest compressions

It is reasonable for healthcare providers to be prepared to initiate pacing in patients who do not respond to atropine (or second-line drugs if these do not delay definitive management). Immediate pacing might be considered if the patient is severely symptomatic. If the patient does not respond to drugs or transcutaneous pacing, transvenous pacing is probably indicated.

Summary

The recommendations for electrical therapies described in this section are designed to improve survival from SCA and life threatening arrhythmias. Whenever defibrillation is attempted, rescuers must coordinate high-quality CPR with defibrillation to minimize interruptions in chest compressions and to ensure immediate resumption of chest compressions after shock delivery.
### Sinus Tachycardia

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>&gt;100 per minute</td>
</tr>
<tr>
<td>QRS Complex</td>
<td>Normal and P for every QRS complex</td>
</tr>
<tr>
<td>Rhythm</td>
<td>Sinus</td>
</tr>
<tr>
<td>P Wave</td>
<td>Present</td>
</tr>
</tbody>
</table>

### Atrial Ectopic

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>Sinus rate</td>
</tr>
<tr>
<td>QRS Complex</td>
<td>Normal and narrow</td>
</tr>
<tr>
<td>Rhythm</td>
<td>Regular sinus with atrial ectopic beat</td>
</tr>
<tr>
<td>P Wave</td>
<td>Normal P wave with presence of ectopic atrial beat</td>
</tr>
</tbody>
</table>
**Atrial Fibrillation**

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rate</strong></td>
<td>Wide range of ventricle response</td>
</tr>
<tr>
<td><strong>QRS Complex</strong></td>
<td>Present</td>
</tr>
<tr>
<td><strong>Rhythm</strong></td>
<td>Irregular</td>
</tr>
<tr>
<td><strong>P Wave</strong></td>
<td>Chaotic atrial fibrillatory waves</td>
</tr>
</tbody>
</table>

**Atrial Flutter**

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rate</strong></td>
<td>Atrial rate 100 to 350 per minute</td>
</tr>
<tr>
<td><strong>QRS Complex</strong></td>
<td>Present</td>
</tr>
<tr>
<td><strong>Rhythm</strong></td>
<td>Regular</td>
</tr>
<tr>
<td></td>
<td>Ventricular rhythm often regular</td>
</tr>
<tr>
<td></td>
<td>Set ratio atrial rhythm e.g. 2 to 1</td>
</tr>
<tr>
<td><strong>P Wave</strong></td>
<td>No true P waves</td>
</tr>
<tr>
<td></td>
<td>Flutter waves in “sawtooth” pattern</td>
</tr>
</tbody>
</table>
**Accessory – Mediated Supraventricular Tachycardia**

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rate</strong></td>
<td>Atrial rate 120 to 150 per minute</td>
</tr>
<tr>
<td><strong>QRS Complex</strong></td>
<td>Normal and Narrow</td>
</tr>
<tr>
<td><strong>Rhythm</strong></td>
<td>Regular</td>
</tr>
<tr>
<td><strong>P wave</strong></td>
<td>Seldom seen due to rapid rate because p wave “hidden” in preceding T waves</td>
</tr>
</tbody>
</table>

**Sinus Bradycardia**

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rate</strong></td>
<td>&lt;60 per minute</td>
</tr>
<tr>
<td><strong>QRS Complex</strong></td>
<td>Normal</td>
</tr>
<tr>
<td><strong>Rhythm</strong></td>
<td>Regular Sinus</td>
</tr>
<tr>
<td><strong>P Wave</strong></td>
<td>Normal, every P wave followed by QRS complex</td>
</tr>
</tbody>
</table>
First-Degree AV Block

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Rate</th>
<th>Sinus rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QRS Complex</td>
<td>Normal and Narrow</td>
</tr>
<tr>
<td></td>
<td>Rhythm</td>
<td>Regular Sinus</td>
</tr>
<tr>
<td></td>
<td>P Wave</td>
<td>Normal, every P wave follow by QRS complex</td>
</tr>
<tr>
<td></td>
<td>PR</td>
<td>Prolonged &gt; 0.20 second and fixed</td>
</tr>
</tbody>
</table>

Second-Degree AV Block Morbitz Type I (Wenkebach)

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Rate</th>
<th>Sinus rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QRS Complex</td>
<td>Normal and Narrow</td>
</tr>
<tr>
<td></td>
<td>Rhythm</td>
<td>Regular Sinus</td>
</tr>
<tr>
<td></td>
<td>P Wave</td>
<td>P wave not followed by QRS complex</td>
</tr>
<tr>
<td></td>
<td>PR</td>
<td>Progressive lengthening of PR interval occurs from cycle to cycle, then one P wave is not followed by QRS complex - “dropped beat”</td>
</tr>
</tbody>
</table>
### Second-Degree AV Block Moritz Type II

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rate</strong></td>
<td>Usually 60 to 100 per minute</td>
</tr>
</tbody>
</table>
| **QRS Complex**  | Normal and Narrow  
(Wide QRS complex implies low block relative to AV node) |
| **Rhythm**       | Atrial regular, ventricular irregular |
| **P Wave**       | Some P wave not followed by QRS complex |
| **PR**           | Constant and set, no progressive prolongation |

### Third-Degree AV

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Details</th>
</tr>
</thead>
</table>
| **Rate**         | Atrial rate 60 to 100 per minute, dissociated from ventricle rate  
Ventricle rate depend on rate of ventricle escape beats |
| **QRS Complex**  | Narrow implies high block relative to AV node  
Wide implies low block relative to AV node |
| **Rhythm**       | Atrial and ventricular rate regular but independently “dissociated” |
| **P Wave**       | Normal |
### Ventricle Ectopics

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>Sinus rate with presence of ventricular ectopics</td>
</tr>
<tr>
<td>QRS Complex</td>
<td>Normal QRS complexes with presence of single broad QRS complex</td>
</tr>
<tr>
<td>Rhythm</td>
<td>Sinus rate with irregular ventricular rate</td>
</tr>
<tr>
<td>P Wave</td>
<td>Present before normal QRS complex</td>
</tr>
</tbody>
</table>

### Ventricle Bigeminy

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>Sinus rate with presence of ventricular ectopic</td>
</tr>
<tr>
<td>QRS Complex</td>
<td>Normal QRS complexes with alternating broad QRS complexes</td>
</tr>
<tr>
<td>Rhythm</td>
<td>Sinus rate with alternating ventricular rate</td>
</tr>
<tr>
<td>P Wave</td>
<td>Present before normal QRS complex</td>
</tr>
</tbody>
</table>
### Couplet

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinus rate</td>
<td></td>
</tr>
<tr>
<td>QRS Complex</td>
<td>Normal QRS complexes with presence of broad QRS complexes in Couplet</td>
</tr>
<tr>
<td>Rhythm</td>
<td>Sinus rate with irregular ventricular rate</td>
</tr>
<tr>
<td>P Wave</td>
<td>Present before normal QRS complex</td>
</tr>
</tbody>
</table>

### Monomorphic VT

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;100 per minute, typically 120 to 250 per minute</td>
<td></td>
</tr>
<tr>
<td>QRS Complex</td>
<td>Wide and bizarre, PVC like complexes &gt;0.12 second</td>
</tr>
<tr>
<td>Rhythm</td>
<td>Regular ventricular rate</td>
</tr>
<tr>
<td>P Wave</td>
<td>Seldom seen but present</td>
</tr>
<tr>
<td>Fusion Beats</td>
<td>Occasional chance capture of a conducted P wave Resulting QRS “hybrid” complex, part normal and part ventricle</td>
</tr>
<tr>
<td>Nonsustained VT</td>
<td>Last &lt;30 seconds</td>
</tr>
</tbody>
</table>
**Defining Criteria**

<table>
<thead>
<tr>
<th>Rate</th>
<th>150 to 250 per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>QRS Complex</td>
<td>Display classic spindle-node pattern</td>
</tr>
<tr>
<td>Rhythm</td>
<td>Irregular ventricular rhythm</td>
</tr>
<tr>
<td>P Wave</td>
<td>Non-existent</td>
</tr>
</tbody>
</table>

---

**Polymorphic VT**

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Rate</th>
<th>QRS Complex</th>
<th>Rhythm</th>
<th>P Wave</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>150 to 250 per minute</td>
<td>Display classic spindle-node pattern</td>
<td>Irregular ventricular rhythm</td>
<td>Non-existent</td>
</tr>
</tbody>
</table>

---

**Torsades De Pointes**

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th>Rate</th>
<th>QRS Complex</th>
<th>QT Interval</th>
<th>Rhythm</th>
<th>P Wave</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>150 to 250 per minute</td>
<td>QRS showed continually changing of axis (hence ‘turning of point’)</td>
<td>Prolonged</td>
<td>Irregular ventricular rhythm</td>
<td>Non-existent</td>
</tr>
</tbody>
</table>

---

[Image of ECG showing Polymorphic VT]

[Image of ECG showing Torsades De Pointes]
**Ventricular Fibrillation**

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rate</strong></td>
<td>150 to 300 per minute</td>
</tr>
<tr>
<td><strong>QRS Complex</strong></td>
<td>Unable to determine; no recognizable P, QRS or T waves</td>
</tr>
<tr>
<td><strong>Rhythm</strong></td>
<td>Indeterminate</td>
</tr>
<tr>
<td><strong>Amplitude</strong></td>
<td>Can be described as fine (peak to trough 2 to &lt; 5 mm), or medium (5 to &lt; 10 mm) or coarse (10 to &lt;15 mm) or very coarse (&gt; 15 mm)</td>
</tr>
</tbody>
</table>

**Asystole**

<table>
<thead>
<tr>
<th>Defining Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rate</strong></td>
<td>No ventricle activity</td>
</tr>
<tr>
<td><strong>QRS Complex</strong></td>
<td>No deflection seen</td>
</tr>
<tr>
<td><strong>Rhythm</strong></td>
<td>No ventricle activity</td>
</tr>
</tbody>
</table>
### Adrenaline

**Introduction**
- Naturally occurring catecholamines with alpha and beta effects
- Administration in cardiac arrest will cause intense vasoconstriction (alpha adrenergic action) and divert cardiac output to vital organ such as brain and heart
- Can improve ROSC although no difference in survival (Retrospective study)
- Facilitate defibrillation by improving myocardial blood flow during CPR

**Indications**
- Cardiac arrest: The first drug to be used in cardiac arrest of whatever cause
- Symptomatic bradycardia: Can be considered after atropine as an alternative infusion to dopamine
- Severe hypotension
- Anaphylaxis

**Dose and Administration**

**For Cardiac Arrest**
- IV/IO: 1mg (10ml of 1:10000 solution), administered every 3-5minutes followed by 20ml flush
- Higher dose: Specific indication only such as beta blocker or calcium channel blocker overdose. Can use up to 0.2mg/kg
- Infusion: Infusion rate of 1µg/min titrated to effects (typically 2-10µg/minute)
- If IV/IO is difficult to establish, adrenaline can be given through ETT at dose of 2-2.5mg

**For Profound Bradycardia or Hypotension**
- Infusion at 2-10µg/minute, titrated to response

**Adverse Effects and Precautions**
- Hypertension after resuscitation
- Tachyarrhythmias
- Tissue necrosis if extravasation occurs

Following ROSC, even small doses of adrenaline (50-100µg) may induce tachycardia, myocardial ischaemia, VT and VF. If further dose is required, it must be titrated carefully to achieve an appropriate blood pressure

### Atropine

**Introduction**
- An anticholinergic agent
- Antagonises the action of the parasympathetic neurotransmitter acetylcholine at muscarinic receptors. Therefore, it blocks the effect of the vagus nerve on both the sino-atrial (SA) node and the atrio-ventricular (AV) node, increasing sinus automaticity and facilitating AV node conduction

**Dose and Administration**

- The recommended dose for bradycardia is 0.5mg IV every 3 to 5 minutes to a max total dose of 3mg
- Doses of atropine sulfate of < 0.5mg may paradoxically result in further slowing of the heart rate
- Atropine administration should not delay external pacing for patients with poor perfusion
### Introduction
- First line drug for symptomatic Bradycardia
- Organophosphate poisoning

### Dose and Administration
- Use atropine cautiously in the presence of acute coronary ischemia or MI; increased heart rate may worsen ischemia or increase infarction size.
- Will not be effective in infranodal (type II) AV block and new third-degree block with wide QRS complexes

### Adenosine

#### Introduction
- Naturally occurring purine nucleotide
- Slows transmission across AV node but has little effect on other myocardial cells or conduction pathways
- Highly effective for terminating paroxysmal SVT with re-entrant circuits that include AV node (AVNRT)
- In other narrow-complex tachycardias, adenosine will reveal the underlying atrial rhythms by slowing the ventricular response

#### Indications
- First drug for most form of stable narrow-complex PSVT
- Effective in terminating stable narrow-complex PSVT due to reentry involving AV node or sinus node
- May be considered for narrow-complex reentry tachycardia while preparing for cardioversion

#### Dose and Administration
- Give 6 mg adenosine as a rapid IV push through a large (e.g. antecubital) vein followed by a 20mL saline flush. If unsuccessful, this can be followed with up to two doses each of 12mg every 1-2 minutes

#### Side Effects and Precautions
- Transient unpleasant side effects, in particular nausea, flushing, and chest discomfort
- Should not be given in patient with asthma
- In WPW syndrome, blockage of conduction across the AV node by adenosine may promote conduction across an accessory pathway
- In supraventricular arrhythmias, this may cause a dangerously rapid ventricular response. It may also precipitate atrial fibrillation associated with a dangerously rapid ventricular response.
- Larger doses may be required for patients with a significant blood level of theophylline, caffeine, or theobromine
- The initial dose should be reduced to 3 mg in patients taking dipyridamole or carbamazepine, those with transplanted hearts, or if given by central venous access

### Amiodarone

#### Introduction
- An antiarrhythmic with complex pharmacokinetics and pharmacodynamics
- Act on sodium, potassium and calcium channels
- Poses alpha and beta-adrenergic blocking properties.

#### Dose and Administration
- For refractory VF/pulseless VT
  - IV/IO 300mg bolus (dilute in 20mL Dextrose 5% solution)
  - Can repeat in 3-5minutes, 150 mg
**Calcium**

**Introduction**
- Essential for nerve and muscle activity
- Plays a vital role in the cellular mechanism underlying myocardial contraction
- No data supporting any beneficial action for calcium after cardiac arrest
- Some studies have suggested a possible adverse effect when given routinely during cardiac arrest (all rhythms)

**Indications**
- Refractory pulseless VT/VF (between the third and fourth shock when refractory to defibrillatory shock and vasopressor)
- Stable and unstable tachyarrhythmias

**Dose and Administration**
- The initial dose of 10 ml 10% calcium chloride (6.8 mmol Ca²⁺) may be repeated if necessary

**Side Effects and Precautions**
- Calcium can slow heart rate and precipitate arrhythmias
- In cardiac arrest, calcium may be given by rapid intravenous injection
- In the presence of a spontaneous circulation give it slowly
- Do not give calcium solutions and sodium bicarbonate simultaneously via the same route

**Lignocaine**

**Introduction**
- Act as a calcium channel blocker

**Indications**
- Alternative to amiodarone in cardiac arrest from VT/VF
- Stable monomorphic VT with preserved ventricular function

**Dose and Administration**
- Cardiac arrest from VT/VF Initial dose: 1-1.5mg/kg IV or IO
- For refractory VF: may give additional dose 0.5-0.75mg/kg and repeat 5-10 minutes up to 3 times or maximal dose of 3mg/kg
### Dopamine

#### Introduction
- A chemical precursor of noradrenaline that stimulates both alpha and beta adrenergic receptors
- In addition, there are receptors specific for dopamine (DA1, DA2 dopaminergic receptors)
- Stimulates the heart through both alpha and beta receptors
- Both a potent adrenergic receptor agonist and a strong peripheral dopamine receptor agonist. These effects are dose dependent.

#### Indications
- Second-line drug for symptomatic bradycardia
- Use for hypotension (systolic BP < 70 to 100 mm Hg) with signs and symptoms of shock

#### Dose and Administration
- Usual infusion rate is 2-20µg/kg/minute and dose titrated according to response

#### Side Effects and Precautions
- In overdose it can cause slurred speech, altered consciousness, muscle twitching and seizure
- It also can cause hypotension, bradycardia, heart block and asystole

### Magnesium

#### Introduction
- An electrolyte important for maintaining membrane stability
- Hypomagnesemia can cause myocardial hyperexcitability especially in the presence of hypokalemia or digoxin
- Given for hypomagnesemia and Torsades de pointes
- Insufficient evidence to recommend for or against its routine use in cardiac arrest

#### Indications
- Recommended in cardiac arrest only if Torsades de pointes or if hypomagnesemia is present
- Life threatening ventricular arrhythmias due to digitalis toxicity

#### Dose and Administration
- Cardiac arrest due to Torsades de pointes or hypomagnesemia: 1-2g diluted in 10 mL D5% to be given over 5-20 minute
- Torsades de pointes with pulse or AMI with hypomagnesemia: Loading dose of 1-2g mixed with 50 mL D5% over 5-60 minute, followed with 0.5 to 1g/hour (titrate to control Torsades)

#### Side Effects and Precautions
- Occasional fall in blood pressure with rapid administration
- Use with caution if renal failure is present
### Vasopressin

**Introduction**
- A non-adrenergic peripheral vasoconstrictor
- Causes coronary and renal vasoconstriction
- No difference in outcome (ROSC, survival to discharge or neurological outcome) with vasopressin (40 units IV) versus adrenaline 1 mg as a first line vasopressor in cardiac arrest (three RCT and meta-analysis of the trials)

**Indications**
- As an alternative pressor to adrenaline in the treatment of refractory VF or pulseless VT
- Maybe useful as alternative to adrenaline in PEA and asystole

**Dose and Administration**
- For cardiac arrest
  40 units IV/IO may replace 1st or 2nd dose of Adrenaline

**Adverse Effects and Precautions**
- Potent peripheral vasoconstrictor. It may precipitate cardiac ischaemia and angina

### Sodium Bicarbonate

**Introduction**
- A strong alkaline agent with high sodium and bicarbonate load
- Not recommended for routine use in cardiac arrest

**Indications**
- Known preexisting hyperkalemia
- Known preexisting bicarbonate responsive acidosis e.g. : aspirin overdose, diabetic ketoacidosis, tricyclic antidepressant or cocaine
- Prolonged resuscitation with effective ventilation. Upon return of spontaneous circulation after long arrest interval
- Not useful nor effective in hypercarbic acidosis (e.g. cardiac arrest or CPR) without tracheal intubation

**Dose and Administration**
- 1 mEq/kg IV bolus

**Adverse Effects and Precautions**
- May cause tissue necrosis if extravasation occurs
- Do not administer with same IV line used for vasopressors
- Avoid use with IV line used for IV Calcium
**BLS Adult Algorithm**

**Danger, UnResponsive, Shout for resuscitation team, Airway, No or abnormal Breathing**

**CPR 30:2**
- Attach defibrillator/monitor
- Minimize interruptions

**NORMAL**
- Rhythm?
  - Return of Spontaneous Circulation

**ABNORMAL**
- Shockable?
  - Non-Shockable (PEA/Asystole)
  - Shockable (VF/Pulseless VT)
  - 1 Shock
    - Immediately resume:
      - CPR for 2 minutes
      - Minimise interruptions
    - Post Resuscitation Care

**During CPR**
- Push hard and fast (at least 100/minute)
- Allow complete chest recoil after each compression
- Minimize interruptions
- 1 cycle CPR 30:2 (2 minute)
- Avoid hyperventilation
- Secure airway and confirm placement
- Rotate compressor every 2 minutes with rhythm check
- Search and treat for reversible causes -5H and 5T
  - Hydrogen ion
  - Hypoxia
  - Hypothermia
  - Hypovolemia
  - Hypo/hyperkalemia
  - Tamponade, cardiac
  - Tension pneumothorax
  - Thrombosis, Pulmonary
  - Thrombosis, Coronary
  - Toxins
- Vascular access (IV/IO)
- Give adrenaline every 3-5 minute
**Pulseless Arrest**
- BLS algorithm: DRS ABC
- Attach monitor/defibrillator when available

**Not Shockable (Asystole/PEA)**
- Start CPR immediately for 2 minutes.
  - When IV/IO available, give Adrenaline 1 mg IV/IO, repeat every 3-5 minutes OR
  - Give 1 dose of Vasopressin 40U IV/IO to replace 1st or 2nd dose of Adrenaline

**Give 2 minutes of CPR**

**Asystole/PEA algorithm**

**During CPR**
- Push hard and fast (at least 100/minute)
- Allow complete chest recoil after each compression
- Minimize interruptions
- 1 cycle: CPR 30:2 (2 minutes)
- Avoid hyperventilation
- Secure airway and confirm placement
- Rotate compressor every 2 minutes with rhythm check
- Search and treat for reversible causes*

**Shockable Rhythm?**

**Shockable (Pulseless VT/VF)**
- Give 1 shock
  - Manual biphasic: device specific (120-200J)
  - AED: device specific
  - Monophasic 360J
- Resume CPR immediately

**Give 2 minutes of CPR**

**Continue CPR while defibrillator is charging**
If shockable rhythm, give 1 shock
**Resume CPR immediately after shock**
When IV/IO available, during CPR (before or after the shock)
- Give Adrenaline 1 mg IV/IO, repeat every 3-5 minutes, OR
- Give 1 dose of vasopressor 40U IV/IO to replace 1st or 2nd dose of Adrenaline

**Continue CPR while defibrillator is charging**
If shockable, give 1 shock
**Resume CPR immediately after shock**
Consider anti-arrhythmics: during CPR,
- Give Amiodarone 300 mg IV/IO, 150 mg second dose
- Consider magnesium 1-2g IV/IO loading dose for Torsades de pointes
**Bradycardia (with pulse) Algorithm**

- Assess using the ABCD approach
- Ensure oxygen given and obtain IV access
- Monitor ECG, BP, SpO₂, record 12-lead ECG
- Identify and treat reversible causes (e.g. electrolyte abnormalities)

**Assess for Evidence of Adverse Signs:**
- Shock
- Syncope/Altered mental status
- Myocardial ischaemia
- Heart failure

**Risk of Asystole?**
- Recent asystole
- Mobitz II AV Block
- Complete heart block with broad QRS
- Ventricular pause > 3s

**Atropine 0.5mg**

- **yes**
  - Satisfactory Response?
    - **yes**
    - **no**
  - Risk of Asystole?
    - **yes**
    - **no**

- **no**
  - Observe

**Interim measures:**
- Atropine 0.5 mg IV, repeat to max 3 mg
- Dopamine 2-10 μg/kg/minute
- Adrenaline 2-10 μg/minute
- Transcutaneous pacing
**Tachycardia Algorithm with Pulse**

- Assess using the ABCD approach
- Ensure oxygen given and obtain IV access
- Monitor ECG, BP, SpO₂, record 12-lead ECG
- Identify and treat reversible causes (e.g. electrolyte abnormalities)

Possibilities include:
- AF with bundle branch block, treat as for narrow complex
- Pre-excited AF, Consider Amiodarone
- Polymorphic VT (e.g. Torsades de pointes - give magnesium 2 g over 10 minutes)

Assess for evidence of adverse signs:
1. Shock
2. Syncope/Altered mental status
3. Myocardial ischaemia
4. Heart failure

If Ventricular Tachycardia (or uncertain rhythm):
- Amiodarone 300 mg IV over 20-60 minutes; 900 mg over 24 hours
  If previously confirmed SVT with bundle branch block:
  - Give Adenosine as for regular narrow complex tachycardia

Irregular Narrow Complex Tachycardia Probable atrial fibrillation
Control rate with:
- B-Blocker or Diltiazem
- Consider Digoxin or Amiodarone if evidence of heart failure
- Anticoagulate if duration >48 hours

Probable atrial flutter
- Control rate (eg Beta Blocker)

Probable re-entry PSVT:
- Record 12 lead ECG
- If recurs, give Adenosine again & consider choice of anti-arrhythmic prophylaxis

continued on next page
• Assess using the ABCD approach
• Ensure oxygen given and obtain IV access
• Monitor ECG, BP, SpO₂, record 12-lead ECG
• Identify and treat reversible causes (e.g. electrolyte abnormalities)

Assess for evidence of adverse signs:
1. Shock
2. Syncope/Altered mental status
3. Myocardial ischaemia
4. Heart failure

Stable?

no

**Synchronised DC Shock**
*Up to 3 attempts*

• Amiodarone 300 mg IV over 10-20 minutes
• Repeat shock
• Followed by Amiodarone 900 mg over 24 hours
Post Resuscitation Care

Post resuscitation care starts when there is return of spontaneous circulation (ROSC). The chances of achieving ROSC are greatly enhanced when:

- The arrest is witnessed
- The underlying arrhythmia is VF or pulseless VT
- Successful defibrillation is achieved in 2-3 minutes and not longer than 8 minutes
- High quality CPR started and continued

It emphasises the following measures to improve neurological outcome:

- Avoid hyperoxaemia after ROSC; titrate oxygen to SaO\(_2\) 94-96%
- Glucose control to treat hyperglycaemia (>10mmol/L) and avoid hypoglycaemia
- Seizure control
- Maintenance of cerebral perfusion
- Therapeutic hypothermia

A comprehensive post resuscitation treatment protocol for the management of patients after cardiac arrest includes:

1. **Airway**
   - Ensure that the airway is open, oxygenation and perfusion are adequate
   - Titrate oxygen to SaO\(_2\) 94-96%
   - Consider advanced airway support if not instituted
   - Position the unintubated patient in the recovery position to prevent aspiration

2. **Hemodynamics/Circulation**
   - Always assess the haemodynamic status of the patient
   - Monitor vital signs every 5-15 minutes
   - Report patient’s progress at intermittent intervals
   - Report any deterioration or drastic changes immediately
   - When resuscitation is prolonged, hypotension is common following ROSC. Should hypotension persist, dopamine titrated to maintain a systolic blood pressure of 90mmHg is the agent of choice

3. **Therapeutic Hypothermia**
   - Cool patient to 32-34°C for 12-24 hours.
4. **Neurology Status**
   - Assess patient’s ability to respond to verbal or painful stimuli
   - Check the motor response to detect any motor deficit
   - Check the pupils’ size and reaction

5. **Drug Infusion**
   - Consider anti-arrhythmics that have been effective during the resuscitation as infusions
   - Use infusion pumps to ensure accurate delivery
   - Maintain an accurate record of all fluids given

6. **Correct Abnormalities**
   - Actively search and correct underlying abnormalities which may lead to arrest
   - Common abnormalities that may require correction after the arrest include electrolyte imbalances, hypoxaemia and acidosis
   - Correct glucose level > 10.0mmol/l and avoid hypoglycaemia

7. **Transfer to Intensive Care Unit (ICU) or Coronary Care Unit (CCU)**
   - Make immediate arrangement to transfer the patient to ICU or CCU if the patient’s condition remains critical
   - Prior to transfer, ensure the patient’s condition is stabilised and patient fit for transfer

8. **Documentation of the Resuscitation**
   - The resuscitation record is an essential component of any resuscitation effort
   - It provides documentation of the life support procedures that were performed
   - The record allows us to reconstruct the sequence of events with correlation of interventions and responses during the resuscitation
   - The record also allows the evaluation of appropriateness of care and facilities
   - Such documentation allows the evaluation of appropriateness of care and facilities the prospective collection of data for measuring the outcome and effects of training
   - Relatives must always be kept informed

**Summary**

After a successful resuscitation, it is crucial that the patient’s airway, breathing and circulation are secured and stabilized. Haemodynamic and neurological states are closely monitored before and during transfer to ICU or CCU. Relatives must always be kept informed.
Ethical Issues in Cardiopulmonary Resuscitation

Cardiopulmonary resuscitation is carried out to preserve life. However, in most instances, CPR is initiated without considering the fact whether it is done against the wishes of the victim, family members or if an advanced directive exists.

Ethical principles

When caring for those who need CPR, healthcare providers must consider ethical, legal and cultural factors. The decision to initiate or continue resuscitative effort should be guided by knowledge, individual patient or surrogate preferences, local and legal requirements.

There are 5 important aspects of ethical principles that govern the decision for resuscitation:

1) Autonomy:
   Right of patient to accept or refuse therapy. Applied to those who has decision-making capacity unless otherwise as declared by a court of law

2) Beneficence:
   Benefit provided to patient while balancing risks and benefits

3) Non maleficence:
   Doing no harm or further harm

4) Justice:
   Equal distribution of limited health resources and if resuscitation is provided it should be available to all who will benefit from it within the available resources

5) Dignity and Honesty:
   Patient should be treated with dignity. There must be honesty in revealing information in the best interest of the patient
Advanced directives for
**DO NOT ATTEMPT RESUSCITATION (DNAR)**

This is an important aspect in deciding whether to start or withhold CPR. It is a legal binding document in the United States and can be either verbal or written, based on conversations, written directives, living wills or from a durable power of attorney. It is important to note that the court of law accepts written advanced directives more than recollections of conversations.

**Principles of futility**

Medical futility occurs when an intervention is unlikely to benefit the patient. It is also defined when an intervention fails to achieve patient’s intended quality goals or the physician’s physiological goals. Discontinuation of resuscitative efforts or withholding resuscitation should be considered in such situations. However, if the prognosis is in doubt or uncertain, a trial of treatment should be considered until adequate information is gathered to determine the expected clinical course or the likelihood of survival.

Following are instances whereby CPR efforts should be reconsidered:

1) **When to stop CPR**
   - Return of spontaneous circulation
   - Exhaustion
   - Obvious signs of death
   - Decision by the caring physician

2) **When not to start CPR**
   - Presence of an Advanced Directive by the patient or surrogate decision maker
   - Valid DNAR by attending physician
   - Obvious signs of death
   - Injuries incompatible with life
Appendix
### BLS Primary Survey and Intervention

<table>
<thead>
<tr>
<th>Task</th>
<th>Done Correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assesses Danger</td>
<td></td>
</tr>
<tr>
<td>Establishes unResponsiveness</td>
<td></td>
</tr>
<tr>
<td>Shouts for help: Activates Emergency Medical Service (EMS) and gets AED OR</td>
<td></td>
</tr>
<tr>
<td>Directs 2nd rescuer to activate EMS and gets the AED</td>
<td></td>
</tr>
<tr>
<td>Checks and opens the Airway (head tilt-chin lift or if trauma is suspected, jaw thrust without head extension)</td>
<td></td>
</tr>
<tr>
<td>Checks for absent or abnormal Breathing (Assesses for absence of breathing almost simultaneously while opening the airway in less than 10 seconds)</td>
<td></td>
</tr>
<tr>
<td>Starts 30 Chest compressions almost immediately if no breathing or abnormal breathing to be followed by 2 rescue breaths</td>
<td></td>
</tr>
<tr>
<td>Attaches AED-Organized rhythm present</td>
<td></td>
</tr>
<tr>
<td>Check carotid pulse-Pulse present</td>
<td></td>
</tr>
<tr>
<td>Performs rescue breaths just enough to see chest rise at the correct rate 1 breath every 5 to 6 seconds (10 to 12 breath/minute)</td>
<td></td>
</tr>
</tbody>
</table>

### ALS Secondary Survey Case Skills

<table>
<thead>
<tr>
<th>Task</th>
<th>Done Correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inserts OPA and NPA (student should demonstrate both)</td>
<td></td>
</tr>
<tr>
<td>Performs correct bag-mask ventilation</td>
<td></td>
</tr>
<tr>
<td>Administers oxygen</td>
<td></td>
</tr>
<tr>
<td>Reassesses pulse about every 2 minutes</td>
<td></td>
</tr>
</tbody>
</table>

### Critical Action

<table>
<thead>
<tr>
<th>Task</th>
<th>Done Correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performs Primary ABCD</td>
<td></td>
</tr>
<tr>
<td>Properly inserts OPA or NPA</td>
<td></td>
</tr>
<tr>
<td>Can ventilate with bag-mask</td>
<td></td>
</tr>
<tr>
<td>Gives proper ventilation-rate and volume</td>
<td></td>
</tr>
<tr>
<td>Rechecks pulse and other signs of circulation</td>
<td></td>
</tr>
</tbody>
</table>
**Skill Step** | **Critical Performance Steps** | **Adult/Child CPR with AED if done correctly**
--- | --- | ---
1 | Assesses Danger | |
2 | Checks responsiveness | |
3 | Shouts for help: someone to activate EMS and get an AED | |
4 | Opens airway using head tilt-chin lift | |
5 | Checks for absent or abnormal breathing | |
6 | Locates CPR hand position
Delivers 30 compressions at 100/min
Acceptable < 20 seconds for 30 compressions | |
7 | Gives 2 breaths (1 second each) | 

**AED Arrives**

| AED 1 | Turns AED on | |
| AED 2 | Selects proper AED pads and places pads correctly | |
| AED 3 | Clears patient to analyze
(must be visible and verbal check) | |
| AED 4 | Clears patient to shock/presses shock button
(must be visible and verbal check)
Maximum time from AED arrival < 90 seconds | |

**Student Continues CPR**

| 8 | Delivers second cycle of compressions at correct hand position, adequate depth and full chest recoil
Acceptable <20 seconds for 30 compressions | |
| 9 | Gives 2 breaths (1 second each) with visible chest rise | |

**CPR/AED Testing Checklist**

**VF Treated With CPR and Automated External Defibrillation (1 Rescuer)**

<table>
<thead>
<tr>
<th>TEST RESULT</th>
<th>Indicate Pass or Needs Remediation:</th>
<th>P</th>
<th>NR</th>
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**Megacode Testing Checklist 1/2**

**Bradycardia • VF/Pulseless VT • Asystole**

### Critical Performance Steps

#### Team Leader

- Ensures high-quality CPR at all times
- Assigns team members roles

#### Bradycardia Management

- Starts oxygen, places monitor, starts IV
- Places monitor leads in proper position
- Recognizes symptomatic bradycardia
- Administers appropriate drug(s) and doses
- Verbalizes the need for transcutaneous pacing

#### VF/Pulseless VT Management

- Recognizes VF
- Clears before ANALYZE and SHOCK
- Immediately resumes CPR after shocks
- Appropriate airway management
- Appropriate cycles Drug-Rhythm Check/Shock - CPR
- Administers appropriate drug(s) and doses

#### Asystole Management

- Recognizes asystole
- Verbalizes potential reversible causes of Asystole/PEA (H’s and T’s)
- Administers appropriate drug(s) and doses
- Immediately resumes CPR after rhythm checks

### TEST RESULT

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STOP THE TEST
## Critical Performance Steps

**Team Leader**
- Ensures high-quality CPR at all times
- Assigns team members roles

**Tachycardia Management**
- Starts oxygen, places monitor, starts IV
- Places monitor leads in proper position
- Recognizes unstable tachycardia
- Recognizes symptoms due to tachycardia
- Performs immediate synchronized cardioversion

**VF/Pulseless VT Management**
- Recognizes VF
- Clears before ANALYZE and SHOCK
- Immediately resumes CPR after shocks
- Appropriate airway management
- Appropriate cycles Drug-Rhythm Check/Shock - CPR
- Administers appropriate drug(s) and doses

**Asystole Management**
- Recognizes asystole
- Verbalizes potential reversible causes of Asystole/PEA (H’s and T’s)
- Administers appropriate drug(s) and doses
- Immediately resumes CPR after rhythm checks

### TEST RESULT

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## Megacode Testing Checklist 4
### Tachycardia • VF/Pulseless VT • PEA

**Critical Performance Steps**

<table>
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<td>Ensures high-quality CPR at all times</td>
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</table>

**Bradycardia Management**

| Starts oxygen, places monitor, starts IV |
| Places monitor leads in proper position |
| Recognizes tachycardia (specific diagnosis) |
| Recognizes no symptoms due to tachycardia |
| Attempts vagal maneuvers |
| Gives appropriate initial drug therapy |

**VF/Pulseless VT Management**

| Recognizes VF |
| Clear before ANALYZE and SHOCK |
| Immediately resumes CPR after shocks |
| Appropriate airway management |
| Appropriate cycles Drug-Rhythm Check/Shock-CPR |
| Administers appropriate drug(s) and doses |

**Asystole Management**

| Recognizes asystole |
| Verbalizes potential reversible causes of Asystole/PEA (H’s and T’s) |
| Administers appropriate drug(s) and doses |
| Immediately resumes CPR after rhythm checks |

### STOP THE TEST

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**P**

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**NR**
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This book aims to teach doctors and healthcare providers working in critical care areas on how to treat and handle patients in critical condition.